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Effect of atrazine, metribuzin, sulfosulfuron and tralkoxydim on weeds and yield of wheat (*Triticum aestivum*)

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ABSTRACT

An experiment was conducted during the winter seasons of 1997–98 and 1998–99 to find out the effect of 4 herbicides on weeds and yield of wheat (*Triticum aestivum* L. emend. Fiori & Paol.) Of the herbicides, metribuzin being most potent killer of weeds, eliminated *Chenopodium album* L. and gave excellent control of all other weeds. Only this herbicide paralysed severely the growth of *Convolvulus arvensis* L. till harvest of the crop. The next best treatment was atrazine. Its effect on *C. album* was similar to that of metribuzin. It gave remarkable control of *Phalaris minor* Retz. but its effect on *Avena ludoviciana* was inconspicuous while vividly vivid on all other weed species. Isoproturon gave good control of *P. minor* and *C. album* and satisfactory control of all other weed species except *C. arvensis*. Sulfosulfuron proved more effective than tralkoxydim in controlling *A. ludoviciana*. Both the herbicides were effective against *P. minor*. Weed population and weed dry weight were significantly lower under weed-control treatments. The lowest was in metribuzin and it proved significantly superior to all other treatments in arresting both weed population and weed dry matter. The next best treatments were hand-weeding and atrazine. Weed competition resulted in significant decrease in wheat plant height, productive tillers/m row length, grains/panicle and 1,000 grain weight and lowered crop yield by 27.2%. All the weed control treatments caused significant increase in yield attributes and yield in both the years. Hand-weeding affected maximum increase in grain yield which proved significantly superior to all other treatments except metribuzin. (150 g/ha). No significant difference existed between atrazine (100 g/ha) and metribuzin.

Key words : Atrazine, Isoproturon, Metribuzin, Sulfosulfuron, Tralkoxydim, *Triticum aestivum*

Changed morphological structure of wheat varieties and shifting paradigm of sowing time have brought forth marked change in floristic composition of weed flora, weed density and their virulence. These have compounded weed problem further. Yield losses caused by weed species are enormous. With increasing

weed density, yield losses are increasingly marked. Thus, it is important that they are controlled in time to avoid illegitimate use of growth factors to enable the crop plants to express fully by utilizing these factors legitimately meant for them. Herbicides are effective against weed species but most of them are specific and are effective against narrow range of weed species (Pandey *et al.*, 1980). Several new herbicides have been added to the array of herbicides. Not much studies have been made on their efficacy. Besides, a few uncommon herbicides to wheat are being tested to control weeds. Information on efficacy of these is also exiguous in literature. The present study was undertaken to study the effect of new and uncommon herbicides on weeds and yield of wheat.

MATERIALS AND METHODS

An experiment comprising 7 treatments (Table 1) was conducted in the field of Indian Agricultural Research Institute, New Delhi, during winter season of 1997–98 and 1998–99. The treatments were laid out in randomized block design with 4 replications. The soil of the experimental plot was sandy loam, having pH 8.0, organic carbon 0.5%, available P 19 kg/ha and available K 280 kg/ha.

Wheat variety 'HD 2285' was sown 23 cm apart in lines with tractor-drawn seed drill on 27 November 1997 and 2 December 1998 and harvested in first week of May in both the years. The crop received 100 kg N, 18 kg P and 35 kg K/ha. Full dose of P and K and half of N were applied at the time of sowing. The remaining N was applied at first irrigation given 25 days after sowing. The sources of N, P and K were urea, single superphosphate and muriate of potash respectively.

Herbicides were applied with the help of knap-sack sprayer filled with flat-fan nozzle using volume spray of 500 litres/ha, 35 days after sowing. Weed data were transformed ($\sqrt{x+0.5}$) before statistical analysis.

RESULTS AND DISCUSSION

Weeds

Predominant weed species that infested the field were *Avena ludoviciana, Phalaris minor, Chenopodium album* and *Melilotus indica*. Besides, *Aspergula arvensis, Fumaria parviflora, Convolvulus arvensis* and *Cyperus rotundus* also occurred but their population was scanty. Competition by these species was nominal.

Of the herbicides, metribuzin was the most potent killer of weeds. It eliminated *Chenopodium album* and gave excellent control of *Avena ludoviciana, Phalaris minor* and all other weed species (Table 2). It was the only herbicide that paralysed severely the growth of *Convolvulus arvensis* till harvest of the crop. The next best treatment was atrazine; its effect on *C. album* was similar to that of metribuzin. It gave an excellent control of *P. minor* and good control of other dicot weeds but failed to bring about noticeable change in *A. ludoviciana* population. Isoproturon gave excellent of *C. album*, good control of *P. minor* (75%) and satisfactory control of *A. ludoviciana* and other dicot weeds. Sulfosulfuron and tralkoxydim caused marked decrease in *P. minor* population; gave good control of *A. ludoviciana* but

Table 1. Effect of weed-control treatments on weed population and weed dry weight (60 days after sowing)

Treatment	Dose a.i. g/ha	Weed population (0.25 m^2)		Weed dry weight (g/0.25 m^2)	
		1997–98	1998–99	1997–98	1998–99
Weedy check		6.47	5.97	10.67	9.21
Hand weeding		3.13	2.74	1.97	1.53
Sulfosulfuron	25	4.65	3.50	3.79	3.04
Tralkoxydin	350	3.99	4.12	2.60	2.93
Metribuzin	150	2.99	2.15	1.55	1.58
Isoproturon	1000	3.23	2.48	2.71	2.18
Atrazine	100	3.09	3.03	2.44	2.03
CD (P=0.05)		0.33	0.21	0.23	0.14

Table 2. Effect of weed–control treatments on population of major weed species (60 days after sowing

Treatment	Dose a.i. g/ha	% reduction in population of major weed species			
		Phalaris minor	*Avena ludoviciana*	*Chenopodium album*	*Melilotus indica*
Weedy check	-	-	-	-	-
Hand weeding	-	91.0	82.3	91.8	83.0
Sulfosulfuron	25	96.0	79.4	4.9	56.6
Tralkoxydin	350	97.0	61.8	19.6	56.6
Metribuzin	150	98.0	92.5	100.0	95.0
Isoproturon	1000	75.0	58.8	90.0	80.0
Atrazine	100	88.0	29.4	100.0	70.0

Table 3. Effect of weed-control treatments on plant height and productive tillers/m row length

Treatment	Dose (a.i. g/ha)	Plant height (cm)		Productive tillers/m row length	
		1997–98	1998–99	1997–98	1998–99
Weedy check	-	77.7	78.0	84.7	93.3
Hand weeding	-	88.7	92.7	117.7	127.7
Sulfosulfuron	25	83.0	84.0	105.0	107.0
Tralkoxydin	350	83.0	83.0	98.3	106.0
Metribuzin	150	84.0	84.5	108.0	114.4
Isoproturon	1000	81.7	84.0	108.0	108.7
Atrazine	100	82.0	82.0	108.0	113.0
CD (P=0.05)	-	3.0	3.2	4.4	6.6

proved ineffective against *C. album* though they cut down the population of *M. indica* to some extent. The differential behavior of herbicides may be attributed to their differential reaction to weed species. Metribuzin was reported very effective against *P. minor* and other weeds by Singh *et al.* (1999); isoproturon, sulfosulfuron and tralkoxydim against *P. minor* by Pandey and Singh (1984) and Brar *et al.* (1999).

Weed- control treatments significantly decreased weed population and weed dry weight (Table 1). Effect of treatments was almost alike in both the years. Metribuzin affected maximum decrease in weed population and proved significantly superior to all other treatments. Its effect on weed dry weight was similar to that of weed population except that in 1998–99. It was statistically at par with hand-weeding. In hand-weeding, weed population and weed dry weight were significantly lower than the rest of the treatments. The next best treatment was atrazine in reducing biomass accumulation by weeds. Differences among other treatments were significant but not wide. The lowest weed population and weed dry weight in metribuzin were recorded by Singh *et al.* (1999). Pandey (1981) observed drastic decrease in weed population and weed dry weight in isoproturon.

Growth and yield attributes

In both the years, weed control treatments caused significant increase in plant height compared to weedy check (Table 3). Hand-weeding affected maximum increase and proved statistically superior to herbicide treatments. No significant difference existed among herbicide treatments. Weed-control treatments resulted in significant increase in productive tillers. Significantly higher productive tillers were recorded in hand-weeding than herbicide treatments. In 1997–98, atrazine, metribuzin, isoproturon and sulfosulfuron caused identical increase but significantly higher than tralkoxydim, while in 1998–99, atrazine and metribuzin brought about similar increase but much higher than other herbicide treatments. Increase in productive tillers due to sulfosulfuron, tralkoxydim and isoproturon was almost similar but significantly lower than metribuzin. The finding is in conformity with the of Singh *et al.*

Table 4. Effect of weed–contol treatments on yield attributes and yield

Treatment	Dose (a.i. g/ha)	Grains/ear		1,000-grain weight		Grain yield (q/ha)	
		1997–98	1998–99	1997–98	1998–99	1997–98	1998–99
Weedy check	–	31.92	36.63	35.50	35.50	24.0	34.1
Hand weeding	–	43.72	51.10	40.90	40.83	38.6	41.2
Sulfosulfuron	25	39.90	44.92	39.30	39.40	34.9	39.9
Tralkoxydin	350	40.10	45.82	39.83	39.73	35.6	39.6
Metribuzin	150	40.00	49.20	40.10	41.20	37.5	40.9
Isoproturon	1000	39.93	49.73	39.60	39.06	33.8	38.6
Atrazine	100	39.50	47.67	39.73	39.80	35.3	37.9
CD (P=0.05)	–	0.68	1.43	0.55	0.54	2.7	1.4

(1999) and Brar *et al.* (1999).

In both the years, weed-control treatments resulted in significant increase in grains/ear. Maximum increase occurred under hand weeding which proved significantly superior to herbicide treatments. No significant difference existed among herbicide treatments in 1997–98, while in 1998–99, isoproturon and metribuzin resulted in significantly higher number of grains/ear compared to atrazine, sulfosulfuron and tralkoxyim. Effect of weed-control treatments on 1,000 grain weight was well pronounced in both the years. No significant difference existed among atrazine, isoproturon, sulfosulfuron and tralkoxydim. Sulfosulfuron resulted in significantly lower increase than metribuzin in both the years. Increase in plant height, productive tillers and yield attributes were also recorded by Singh *et al.* (1999) and Brar *et al.* (1999).

During both the years, all the weed-control treatments brought about significant increase in grain yield compared to weedy check. Hand-weeding affected the maximum increase which proved significantly superior to atrazine, isoproturon, sulfosulfuron and tralkoxydim but was at par with metribuzin. The latter treatment caused higher increase in grain yield but did not reach the level of significance except isoproturon in 1997–98. Differences among other treatments were non-significant, indicating thereby equally effective in augmenting the crop yield. Higher increase under hand weeding may be assigned to marked increase in productive tillers and noticeable increase in grains/ear, and 1,000-grain weight owing to effective control of weeds during critical period of crop–weed competition. Similar results were reported by Pandey *et al.* (1980). Relatively higher increase in yield in metribuzin may be attributed to excellent control of weeds and increase in productive tillers and effective control of *P. minor* and *A. ludoviciana.* Increase in atrazine may be attributed to excellent control of *P. minor* and other dicot weeds and increase in productive tillers. Brar *et al.* (1999) reported that sulfosulfuron and tralkoxydim gave remarkable control of *P. minor* and caused marked increase in grain yield. Yield reduction due to uncontrolled weed growth was 37.8% in 1997–98 and 17.2% in 1998–99, while average was 27.2%.

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